

CLAIMS

What is claimed is:

1. A desorbition method comprising:

- (a) conveying waste material into a first drum, said first drum having a first gas extraction port;
- (b) sealing the waste material in said first drum;
- (c) heating the waste material in said first drum to a preselected first temperature sufficient to volatize at least one component of the waste material and form a gas;
- (d) extracting the gas from said first drum through said first gas extraction port;
- (e) conveying the waste material remaining after step (c) into a second drum, said second drum having a second gas extraction port;
- (f) sealing the waste material in said second drum;
- (g) heating the waste material in said second drum to a second temperature greater than said first temperature to volatize a component of the waste material and form a gas;
- (h) extracting the gas from said second drum through said second gas extraction port.

2. The method of claim 1 further comprising:

- (i) conveying the waste material remaining after step (h) into a third drum, said third drum having a third gas extraction port;
- (j) sealing the waste material in said third drum;
- (k) heating the waste material in said third drum to a third temperature greater than said second temperature to volatize a component of the waste material and form a gas;
- (l) extracting the gas from said third drum through said third gas extraction port.

3. The method of claim 2 further comprising:

(m) conveying the waste material remaining after step (l) out of said third drum and into a solid cooling drum.

5 4. The method of claim 1 further comprising:

conveying the gas extracted from at least one of said drums into an eductor scrubber that is positioned adjacent to one of said gas extraction ports, said gas scrubber having a suction chamber.

10 5. The method of claim 1 wherein at least one of said gas extraction steps is accomplished by using an eductor scrubber attached to the gas extraction port of one of said drums.

6. The method of claim 2 further comprising:

conveying the gas extracted from said second and said third drums into an eductor scrubber that is positioned adjacent to said second gas extraction port.

15 7. The method of claim 4 further comprising:

cleaning said suction chamber by reciprocating a piston in said chamber.

8. The method of claim 1 wherein at least one of said heating steps comprises:

20 collecting exhaust gas generated by a burner apparatus;

conveying the collected exhaust gas into at least one of said drums.

9. The method of claim 1 wherein said first temperature is greater than 212 degrees F and less than 650 degrees F.

10. The method of claim 9 wherein said second temperature is less than 1500 degrees F.

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11. The method of claim 2 wherein only said third temperature is greater than 1000 degrees F.

12. A method for the recovery of selected materials from waste comprising:

(a) depositing waste material into a first drum, said first drum having a first internal volume and a first gas extraction port;

(b) sealing the waste material in said first drum;

(c) heating the waste material in said first drum to a temperature sufficient to volatilize at least one component of the waste material and form a gas;

(d) extracting the gas from said first drum through said first gas extraction port;

(e) placing the waste material remaining after step (d) into a second drum, said second drum having a second gas extraction port and a second internal volume smaller than said first internal volume;

(f) sealing the waste material in said second drum;

(g) heating the waste material in said second drum to a temperature sufficient to volatilize at least one component of the waste material and form a gas;

(h) extracting the gas from said second drum through said second gas extraction port.

13. The method of claim 12 further comprising:

(i) placing the waste material remaining after step (h) into a third drum, said third drum having a third gas extraction port and having a third internal volume that is less than said first internal volume;

5 (j) sealing the waste material in said third drum;

(k) heating the waste material in said third drum to a temperature sufficient to volatilize at least one component of the waste material and form a gas;

(l) extracting the gas from said third drum through said third gas extraction port.

10 14. The method of claim 13 further comprising:

(m) removing the waste material remaining in said third drum after step (l) and placing it into a solid cooling drum.

15 15. The method of claim 13 wherein said third internal volume is less than said second internal volume.

16. The method of claim 12 wherein said second drum is heated to a higher temperature than said first drum.

20 17. The method of claim 13 wherein said third drum is heated to a higher temperature than said second drum and said second drum is heated to a higher temperature than said first drum.

18. The method of claim 12 further comprising:

conveying the gas extracted from at least one of said drums into an eductor scrubber that is positioned adjacent to one of said gas extraction ports, said gas scrubber having a suction chamber.

5 19. The method of claim 13 further comprising:

conveying the gas extracted from said second and said third drums into an eductor scrubber that is positioned adjacent to said second gas extraction port.

20. The method of claim 18 further comprising:

10 cleaning said suction chamber by reciprocating a piston in said chamber.

21. The method of claim 12 wherein at least one of said heating steps comprises:

collecting exhaust gas generated by a burner apparatus;

conveying the collected exhaust gas into at least one of said drums.

15 22. Apparatus for treating waste material and recovering selected products therefrom comprising:

a first drum having a first interior volume and a first gas extraction port;

a second drum having a second interior volume smaller than said first interior volume and having a second gas extraction port;

20 a heater heating the waste material in said first drum to a temperature and for a time sufficient to volatize at least one component of the waste material and form a gas of said component;

a conveyor for moving the waste material that is not volatized from said first drum to said second drum;

a heater heating the waste material in said second drum to a temperature and for a time sufficient to volatize at least one component of the waste material and form a gas of said component;
a conveyor for moving the waste material that is not volatized out of said second drum.

5 23. The apparatus of claim 22 wherein said first and second drum are made of different materials.

24. The apparatus of claim 23 wherein said second drum is made of a material that can withstand higher temperatures than the material of said first drum.

10 25. The apparatus of claim 22 wherein at least one of said drums includes an inner sleeve portion and an outer sleeve portion and wherein said inner sleeve portion is made of a material that can withstand higher temperatures than the material of said outer sleeve portion.

26. The apparatus of claim 22 further comprising:

15 a third drum having a third interior volume smaller than said first interior volume and having a third gas extraction port;

a heater heating the waste material in said third drum to a temperature and for a time sufficient to volatize at least one component of the waste material and form a gas of said component;
a conveyor for moving the waste material that is not volatized out of said third drum.

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27. The apparatus of claim 26 wherein said third interior volume is less than said second interior volume.

28. The apparatus of claim 22 further comprising a conveyor for conveying waste material into at least one of said drums, said conveyor comprising a screw member disposed on an incline such that the end of said screw member closest to said drum is higher than the opposite end of said screw member.

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29. The apparatus of claim 22 further comprising a conveyor for conveying waste material into at least one of said drums, said conveyor comprising:

a screw member having first and second ends;

an elongate shell housing said screw member;

10 a baffle attached to said shell and disposed at the end of said shell that is closest to said drum.

30. The apparatus of claim 22 wherein said heater comprises a burner apparatus generating an exhaust gas and wherein the waste material treating apparatus further comprises:

a stack collecting said exhaust gas;

15 a gas inlet in at least one of said drums;

conduit conveying the exhaust gas through said gas inlet and into said drum for heating the waste material.

31. The apparatus of claim 30 further comprising a hot gas generator conveying hot gas into at least one of said drums.

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32. The apparatus of claim 22 further comprising an eductor scrubber that is positioned adjacent to one of said gas extraction ports, said eductor scrubber having a suction chamber with a given cross section.

5 33. The apparatus of claim 26 further comprising an eductor scrubber that is interconnected with said second and third gas extraction ports to receive gas from said second and said third drums, said eductor scrubber being positioned adjacent to said second gas extraction port of said second drum.

10 34. The apparatus of claim 32 further comprising a plunger disposed within said suction chamber of said eductor scrubber and movable between a first and a second position, said plunger having a shape congruent to said cross section of said suction chamber and having a side surface.

15 35. The apparatus of claim 34 wherein said side surface of said plunger includes teeth for scraping said suction chamber as said plunger moves between said first and said second positions.

36. Apparatus for treating waste material and recovering selected products therefrom comprising:
a rotatable desorbition drum having first and second ends and a heating section there between;
a waste inlet in said drum for receiving waste material into said drum;
20 a heater heating the waste material in the heating section of said drum to a temperature and for a time sufficient to volatize at least one component of the waste material and form of gas;
a gas extraction port in said drum permitting a gas formed in the drum to be extracted from the drum;

an eductor scrubber having an inlet to a suction chamber positioned adjacent to said gas extraction port;

said eductor scrubber drawing the gas formed in said drum through said gas extraction port into said suction chamber.

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37. The apparatus of claim 36 further comprising a plunger disposed within said suction chamber of said eductor scrubber and moveable between first and second positions, said plunger having a shape congruent to the cross-sectional shape of such suction chamber and having a side surface for scraping deposits from said suction chamber.

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38. The apparatus of claim 36 wherein said inlet of said suction chamber of said eductor scrubber is attached directly to said gas extraction port of said drum.

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39. The apparatus of claim 36 wherein said heater comprises a burner apparatus generating an exhaust gas, and wherein the waste material treating apparatus further comprises:

a stack collecting the exhaust gas;

a gas inlet in at least one of said drums;

conduit conveying the exhaust gas through said gas inlet and into said drum for heating the waste material.

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40. The apparatus of claim 36 wherein said heater comprises a hot gas generator generating a hot inert gas and wherein the waste treating apparatus further comprises:

a gas inlet in at least one of said drums;

conduit conveying the hot inert gas through said gas inlet and into said drum for heating the waste material.

41. A method for removing vapors generated in a desorbition drum having a gas extraction port,
5 the method comprising: positioning an eductor scrubber adjacent to said gas extraction port; and
injecting a motive fluid into said eductor scrubber to draw vapors from the desorber drum into the
eductor scrubber.

10 42. The method of claim 41 wherein said motive fluid is water.

43. The method of claim 42 further comprising cooling the vapors drawn into the eductor
scrubber to a temperature below the boiling point of water to remove water from the vapors.

15 44. The method of claim 41 wherein said motive fluid is oil.

45. The method of claim 44 further comprising cooling the vapors drawn into the eductor
scrubber to a temperature above the boiling point of water to remove oil, but not water, from the
20 vapors.

46. A desorbition method comprising:

(a) conveying waste material into a desorbition drum, said drum having a gas extraction
port;

(b) sealing said drum from the ambient atmosphere;

25 (c) conveying hot gas into said drum to heat the waste material to a preselected
temperature sufficient to volatize at least one component of the waste material and
form a vapor;

(d) extracting the vapor from said drum through said gas extraction port.

47. The method of claim 46 further comprising:

heating said drum using a burner apparatus;

collecting exhaust gas generated by said burner apparatus;

5 conveying the collected exhaust gas into said drum.

48. The method of claim 46 further comprising:

generating said hot gas in a hot gas generator;

conveying said hot gas from said hot gas generator to said drum;

wherein said hot gas contains substantially no oxygen.

10 49. The method of claim 48 further comprising:

heating said drum using a burner apparatus;

collecting exhaust gas generated by said burner apparatus;

conveying said collected exhaust gas into said drum.

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